(51) International Patent Classification⁷: G06K 19/06

(21) International Application Number: PCT/SE02/01641

(22) International Filing Date:
13 September 2002 (13.09.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0103029-5 13 September 2001 (13.09.2001) SE

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(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:
— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

(54) Title: PRODUCT WITH A CODING PATTERN AND METHOD, DEVICE AND COMPUTER PROGRAM FOR CODING AND DECODING THE PATTERN
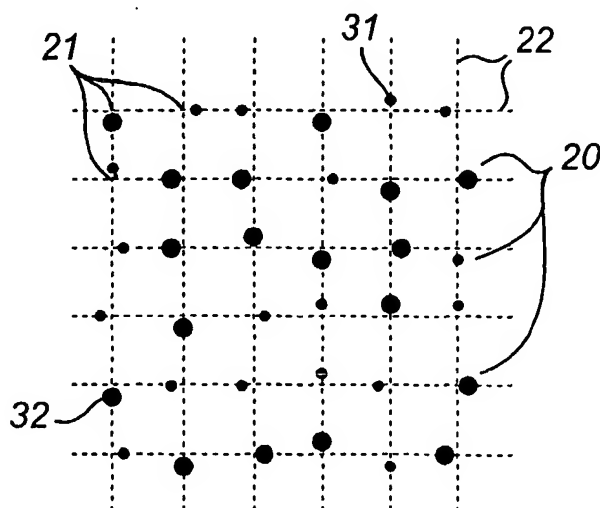
(57) Abstract: A product is provided with a coding pattern, which codes position information in the form of co-ordinates for a plurality of points on the product with the aid of a plurality of marks belonging to each point. The marks have a first parameter which varies for coding of the position information. The marks additionally have a 10 second parameter which varies for coding of further information in the coding pattern. A method and a device for coding of the coding pattern and a method and a device for decoding of the coding pattern are also described. 15

WO 03/042912 A1

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PRODUCT WITH A CODING PATTERN AND METHOD, DEVICE AND COMPUTER PROGRAM FOR CODING AND DECODING THE PATTERN

Field of the Invention

The present invention relates to a product which is provided with a coding pattern, which codes position information in the form of coordinates for a plurality of

5   of points on the product with the aid of a plurality of marks belonging to each point, which marks have a first parameter which varies for coding of the position information.

The invention also relates to a method and a device

10   for coding of a coding pattern and to a method and a device for decoding of a coding pattern.

Background of the Invention

It is already known that it is possible to digitize

15   handwriting by determining how a pen used to create the handwriting is moved. One way of doing this is to use a base for the handwriting provided with a position-coding pattern which codes coordinates for points on the base, and also to provide the pen with a sensor which records

20   the position-coding pattern locally at the tip of the pen as the pen is moved across the base. A processing unit, which can be placed in the pen or at a distance therefrom, can then decode the recorded position-coding pattern so that the movement of the pen across the base can

25   be determined as a series of coordinates.

WO 01/26032, which is assigned to the applicant of the present application and hereby incorporated by reference, describes a position-coding pattern which can be used precisely for digitizing handwriting. The pattern

30   is made up of marks, which for example can be in the form of dots. Each dot has a nominal position represented by an intersection between two lines in a virtual raster, for example a square grid. Each dot codes a fixed value depending on its location in relation to the nominal

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position. The dots can have four possible locations, for example, one on each of the four raster lines extending from the intersection, the four different locations coding four different values. The coordinates of a point are

5   coded with the aid of a plurality of dots, for example 6x6 dots. However, each dot contributes to the coding of the coordinates of a plurality of points. If a sensor first reads 6x6 dots and is thereafter moved one dot distance to the side or vertically, the sensor will read

10   dots which code the coordinates of a new point. This type of pattern in which an arbitrary partial surface of pre-determined size defines a position is in the present application referred to as "floating".

Using the pattern in the above-mentioned

15   WO 01/26032, coordinates for a very large number of points can be coded, theoretically 4^{36} points if each point is coded with 6x6 dots. All these points can be said to form an imaginary surface. WO 01/48685, which is also assigned to the applicant of the present invention

20   and hereby incorporated by reference, describes how such an imaginary surface can be used for information manage-ment. More specifically, different partial areas on the imaginary surface are dedicated to different types of information management. It is then possible to control

25   how information which is recorded digitally is to be handled by providing bases with a position-coding pat-tern which corresponds to different partial areas on the imaginary surface. For example, a first base can be pro-vided with a position-coding pattern which means that

30   information which is written on the position-coding pat-tern and is recorded digitally by the pen is sent to a predetermined computer for storage in the latter. Corre-spondingly, another base can be provided with a position-coding pattern which means that information which is re-

35   corded digitally with the aid of this position-coding pattern is sent as an e-mail to an address indicated by the user on the base.

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It will be evident from the above that it would be useful for the total position-coding pattern to be able to code coordinates for as large a number of points as possible. This applies not only to the position-coding

5   pattern described above, but to all coding patterns which can be used for information management. Examples of other coding patterns are to be found in US-A-5,168,147, US-A-5,245,165 and US-A-5,477,012.

One possible way of coding coordinates for more

10   points would be to increase the number of values which each mark can code. In the above example, each dot could therefore be allowed to have more than four different possible locations for coding more than four different values. However, the greater the number of different

15   locations allowed, the more difficult it becomes to de-code the pattern in a correct manner.

WO 01/48685 also describes how the pen which records the position-coding pattern can store different digital templates which define how the information on the physi-

20   cal base with a position-coding pattern is to be inter-preted. An e-mail template can, for example, specify that a base with a corresponding position-coding pattern has a first field which is intended for a message, a second field which is intended for an e-mail address to be

25   interpreted by ICR (Intelligent Character Recognition), and a third field which constitutes a "send" box which the user ticks in order to initiate the forwarding of recorded information.

Different bases can have fields with different func-

30   tions. The number of fields can be different on different bases. They may also be differently located on the bases, that moreover may have different sizes.

As is also described in WO 01/48685, the position-coding pattern can be arranged differently on the physi-

35   cal base. According to a first alternative, the position-coding pattern on the base can be continuous, which means that it corresponds to a continuous area of the imaginary

surface. The unit which is to interpret and process the digital information recorded from the base must then know the layout of the base, i.e. which fields there are on the base and where these are located. If many different

5   layouts are allowed, which is of course desirable, a large amount of information has to be stored so that it is available to the unit which is to process the information. This is particularly a problem if the processing unit has a limited storage capacity and/or if it takes

10   a long time to change the information once it has in fact been stored. This may be the case, for example, if the processing unit consists of a portable user unit, such as the pen in WO 01/48685.

     According to a second alternative, the position-

15   coding pattern on the base can correspond to a combination of a plurality of separate partial areas on the imaginary surface so that the position-coding pattern is discontinuous. For example, the position-coding pattern in the first field can then correspond to a first partial

20   area on the imaginary surface which is dedicated to message information, the position-coding pattern in the second field can correspond to a second partial area which is dedicated to address information which is to be processed by ICR, and the position-coding pattern in

25   the third field can correspond to a partial area which is dedicated to "send" boxes. In this case, the location of fields on the base is therefore not related to the location of corresponding partial areas on the imaginary surface. In this alternative, the unit which is to inter-

30   pret and process the digital information from the base has to store a smaller quantity of information because it only needs to know the coordinates of the different partial areas on the imaginary surface.

     In certain situations, however, the continuous

35   position-coding pattern is still to be preferred. If the pattern is of the floating type, positions will not be able to be defined in a boundary area between two diffe-

rent fields in the discontinuous position-coding pattern
since the dots in the boundary area do not code coordi-
nates for adjacent points on the imaginary surface. One
way of solving this problem is to have no position-coding
5   pattern in the boundary area so that points belonging to
one or other field can be detected unambiguously. Such
boundary areas without position-coding pattern can be un-
desirable, especially when the product is small. It would
therefore be advantageous to be able to use templates
10   with a continuous position-coding pattern and without the
unit intended to process the information having to store
the specific template for every conceivable layout on the
physical base. This is particularly desirable when dif-
ferent parties are to be allowed themselves to produce
15   bases with different layouts at the same time as the
digital information which is recorded from these bases is
to be able to be processed in one or more central units
whose template databases cannot be updated every time a
party wishes to use a new and not previously defined lay-
20   out, or in user units with limited storage capacity and
where it is difficult to update the template database
after manufacture when the user has received the user
unit.

25   Summary of the Invention
        An object of the present invention is therefore to
wholly or partially solve the above-mentioned problems.
        This object is achieved with the aid of a product
according to claim 1, a method for coding according to
30   claim 16, a device for coding according to claim 26, a
method for decoding according to claim 27, and a device
for decoding according to claim 35 and a product accor-
ding to claim 36.
        According to a first aspect, the invention thus
35   relates to a product which is provided with a coding
pattern, which codes position information in the form of
coordinates for a plurality of points on the product with

the aid of a plurality of marks belonging to each point,
the marks having a first parameter which varies for cod-
ing of the position information. The marks also have
a second parameter which varies for coding of further

5   information in the coding pattern.

Instead of coding further information in the coding
pattern with the aid of the same parameters, such as the
location in the example mentioned by way of introduction,
another parameter is therefore used, such as color or

10   size, for coding the further information. The further
information is then more easily detectable with a sensor,
since the information is now coded in two different
"dimensions". The risk of incorrect detections is there-
by reduced.

15   Another advantage of coding the further information
with the aid of a second parameter is that the position
information is unaffected by the further information.
Thus, this new coding pattern is compatible with an old
position-coding pattern which does not code further

20   information by a second parameter. This in turn means
that a user unit adapted to decode the old coding pattern
is able to decode the position information in the new
coding pattern, and that a new user unit adapted to
decode the new coding pattern is able to decode the

25   position information in the old position-coding pattern.
Still another advantage is that the number of posi-
tions codeable by the coding pattern remains the same
despite the inclusion in the coding pattern of the
further information.

30   The use of a second parameter for coding further
information may be particularly suited for "floating"
coding pattern.

The marks can be optically detectable, and the first
parameter and the second parameter can thus also be opti-

35   cally detectable. The parameters can typically relate to
shape, color, gray scale, size, angle position, location
and/or degree of filling of the marks. The coding pattern

can be of the type mentioned by way of introduction and described in WO 01/26032, but the principles of the invention are also applicable to other position-coding patterns which are made up of a plurality of discrete

5 marks, each of which can code at least two different values.

The second parameter can be detectable independently of the first parameter so that the detection of the second parameter does not affect the detection of the

10 first parameter. The parameters may in other words be orthogonal to each other. The first parameter and the second parameter can be one of the following pairs: location and size; location and color; size and location; size and shape; size and color; shape and location; shape

15 and color; shape and size; color and location; color and size; and color and shape. A preferred combination is location and size, since these parameters are comparatively easy to detect.

The further information can be further position in-

20 formation, the variation in the second parameter making it possible to code at least two further values for each mark. In the case set out by way of introduction, where a mark codes four different values with the aid of four different locations, it would be possible, by varying

25 a second parameter of the mark between two different values, for example the "size" parameter between the values of "small" and "large", to code eight different values for each mark, which would thus permit coding of coordinates for 8^{36} points in the earlier example where

30 each point was coded with 6x6 marks.

The further information can alternatively be information other than position information, and it can in this case form a second information layer, the position information constituting the first information layer. The

35 second information layer can, for example, contain height information related to positions on a map which is coded with the position information.

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It is also conceivable to code further information in the second information layer with very high redundancy so that when a certain amount of position information has been digitally recorded with the aid of the coding

5   pattern, it is very highly probable that the further in- formation in the second information layer has also been recorded. The further information could, for example, be an address to which the information digitally recorded with the aid of the coding pattern is to be sent.

10   The second parameter can furthermore be used for marking out an area of the coding pattern, so that a user unit can recognize that coordinates recorded with the aid of the coding pattern originate from the area without having to utilize a template. In this way, new page lay-

15   outs can be created without new templates having to be created.

The area can be an area having an associated pre- determined function. Hence, it can be designated as a functional area. The function associated with the area

20   can be defined in the processing unit which processes the information recorded with the aid of the coding pattern. The function may for instance be to send the information recorded from different parts of the coding pattern to an address, to perform character-recognition on the in-

25   formation recorded from the marked-out area, to provide a feed-back to the user or to interpret the information recorded from the area as a specific type of information.

Phrased in other words, the further information can be used in order to define at least two different areas

30   or fields on the coding pattern. The areas can be defined by the second parameter being given a value in one area and another value in the other area. This possibility of defining areas in the coding pattern, so that it is pos- sible to tell from the digitally recorded information

35   which area the information is associated with, can be used to reduce the initially stated problem of storage of template information. A party wishing to produce a new

layout, for example with an address field at the top of a
page instead of at the bottom of a page, would, with the
aid of the second parameter, be able to define an address
field at the top of a page with a continuous position-

5   coding pattern. This of course presupposes that in the
unit which is to interpret the digitally recorded infor-
mation it has been defined that information with a cer-
tain value of the second parameter is to be interpreted
as address information. The technique of using the second

10   parameter to depict digitally detectable areas on the
position-coding pattern affords the same advantages as
regards the need for information storage as the use of
templates with a discontinuous position-coding pattern.

     The further information can alternatively define

15   whether a predetermined area in the coding pattern is
activated or not. A template can then include a plurality
of areas with the same function located at different
places, for example a plurality of address fields or a
plurality of "send" boxes. A party wishing to use the

20   template can then use the second parameter to code fur-
ther information in the coding pattern, which further
information indicates whether corresponding points belong
to an activated area or not. The unit which is intended
to process the recorded information then knows for exam-

25   ple if coordinates which have been recorded from a "send"
box area are to be interpreted as a "send" instruction
or, if the current "send" box is not activated, as an-
other type of pre-defined information.

     As has been explained above, the further information

30   can define how coordinates which are recorded from said
at least two different areas are to be processed. The in-
vention could therefore be described as a product with a
coding pattern which codes coordinates for a plurality of
points on the product through variation of a first para-

35   meter of a plurality of marks belonging to each point;
which coding pattern is intended for digital recording of
information which is written on the coding pattern; and

which coding pattern comprises at least a first area and
a second area; said information which is recorded digi-
tally being intended to be processed in different ways
depending on from which of said areas the information is
5   recorded, and the first area and the second area being
coded in the coding pattern through variation of a second
parameter of the marks.

The coding pattern can also be divided into a plu-
rality of cells, each of these comprising at least two
10   marks, the further information consisting of a cell value
which is coded by said at least two marks for each cell.
In this way, several different types of areas can be cod-
ed with the aid of the second parameter. If, for example,
the coding pattern is divided into cells of two marks and
15   each mark can have two different values for the second
parameter, up to four different types of areas can be
coded with different cell values.

The cells can comprise fewer marks than the plura-
lity of marks, belonging to each point, required for cod-
20   ing of the coordinates for a point. If the further infor-
mation is used, for example, to define areas, a smaller
number of cell values is needed. The cells can then be
made fairly small, so that the marks which define coordi-
nates for a point define several cells. In this way, the
25   coding is made more robust and incorrect decoding is dis-
covered more easily.

In order to further increase the robustness of the
coding, each mark can have at least two predetermined
values for the second parameter and each cell can com-
30   prise at least one mark with each of the predetermined
values. Since in this case there is always a mark with
each possible value, the marks can be compared with each
other on decoding. In this way it is easier, on decod-
ing, to establish the value for a mark which has become
35   distorted during the recording.

If a first area and a second area on a coding pat-
tern are defined with different values of the second

parameter for the marks or with different cell values, problems may arise in a boundary area between the first area and the second area. If the tip of the pen, which the user writes with on the base, and the sensor which

5   records the position-coding pattern are offset from one another, this can in fact mean that the user is writing with the tip of the pen in the first area, but the sensor is recording the coding pattern in the second area, or vice versa. One way of at least partially solving this

10   problem is to have the boundary area comprise cells with the first cell value and cells with the second cell value, i.e. a mixture of cells with different cell values. The mixture can indicate to the unit for processing the information that the recording of digital

15   information is effected in a boundary area, in which case the processing unit can use information which has been recorded immediately before and/or immediately after in order to decide if the current information is to be interpreted as belonging to one area or the other.

20   According to a second aspect, the invention relates to a method in a coding device for producing a coding pattern which codes position information in the form of coordinates for a plurality of points with the aid of a plurality of marks belonging to each point, comprising

25   allocating, for the coding of the position information, to each mark in a digital representation of the marks in the coding pattern one of at least two predetermined values for a first parameter, and allocating to each mark one of at least two predetermined values for a second

30   parameter for coding of further information in the coding pattern.

          The method can be implemented with the aid of a computer program which can be stored in a memory in the coding device or in some other unit from which it can be

35   made available to the coding device.

          According to a third aspect, the invention relates to a device for coding of a coding pattern, which codes

position information in the form of coordinates for a
plurality of points on a surface with the aid of a plu-
rality of marks belonging to each point, which device
comprises processing means for determining a value for

5   a first parameter and a value for a second parameter for
each mark, and a memory for storing the values of the
marks for the first parameter and the second parameter.

The coding device can, for example, be a suitably
programmed computer, in which case the processing means

10   is a processor, or specially adapted hardware of some
type, where the processing means is realized for example
with an ASIC (Application-Specific Integrated Circuit)
or an FPGA (Field-Programmable Gate Array) or with some
arrangement of digital and/or analog circuits.

15   According to a fourth aspect, the invention relates
to a method for decoding, in a decoding device, of a cod-
ing pattern which codes position information in the form
of coordinates for a plurality of points on a product
with the aid of a plurality of marks belonging to each

20   point, comprising the receiving a digital representation
of the coding pattern, decoding the position information
with the aid of the value for the first parameter for at
least some of the marks in the digital representation,
and decoding further information from the coding pattern

25   on the basis of the value for a second parameter for at
least some of the marks in the digital representation.

The method can be implemented with the aid of a com-
puter program which can be stored for example in a memory
in the decoding device or in some other unit from which

30   it can be made available to the decoding device.

According to a fifth aspect, the invention relates
to a device for decoding of a coding pattern which codes
position information in the form of coordinates for a
plurality of points on a product with the aid of a plura-

35   lity of marks belonging to each point, which device com-
prises processing means which are arranged to receive a
digital representation of the coding pattern, to decode

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the position information with the aid of the value for
the first parameter for at least some of the marks in the
digital representation. The processing means are also
arranged to decode further information from the coding
5   pattern on the basis of the value for a second parameter
for at least some of the marks in the digital representa-
tion.

The decoding device can be, for example, a computer-
based unit, in which case the processing means consist
10   of a suitably programmed processor, or specially adapted
hardware of some type, where the processing means are
realized with for example an ASIC or an FPGA or with some
arrangement of digital and/or analog circuits. The decod-
ing device can be an autonomous unit, such as a hand-held
15   user unit, or is built into a fax machine, scanner or
similar apparatus.

It should be noted that the coding device and the
decoding device can have means for executing each of the
steps in the above-described coding and decoding methods.
20   The means can consist, for example, of program codes for
executing the different steps.

Brief Description of the Drawings

The present invention will now be described by means
25   of embodiments and with reference to the accompanying
drawings, in which

Fig. 1 shows schematically a system for information
management, which system uses a coding pattern for con-
trolling the information management.
30   Fig. 2 shows an example of coding of a known posi-
tion-coding pattern with the aid of only a first para-
meter.

Fig. 3 shows an example of coding of a coding pat-
tern with the aid of a first parameter and a second para-
35   meter.

Fig. 4 shows the division, into cells, of a coding
pattern of the same type as in Fig. 3.

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Fig. 5 shows an example of a page layout.

Fig. 6 shows schematically an example of coding of further information.

Fig. 7 shows schematically a coding device.

5   Fig. 8 is a flow chart and shows an example of how coding of a coding pattern can be carried out.

Fig. 9 is a schematic representation of a decoding device.

Fig. 10 is a flow chart and shows an example of how 10   decoding of a coding pattern can be carried out.

Description of Embodiments

Fig. 1 is a schematic representation of a system for information management in which the present invention can 15   be used. The system comprises a base 1 in the form of a sheet of paper, a user unit 2 and an external unit 3. The paper is provided with a coding pattern 4 of which only a small part is indicated schematically in enlarged form. The user unit 2 can be used to write on the paper 1 and 20   at the same time to record what is written in digital form. The digitally recorded information can be processed in the user unit 2 and/or the external unit 3 to which it can be sent automatically (on-line) or at a signal from the user.

25   The position information in the coding pattern 4 can be coded in the manner described in WO 01/26032. As is shown in Fig. 2, the position information is coded with the aid of marks 20 which in this case are in the form of dots. Each dot has a nominal position 21 which is set by 30   the intersection between the lines 22 in a raster. The raster can be virtual, but it is shown here for the sake of clarity with the aid of broken lines. Each dot can be placed at one of four predetermined locations in relation to the nominal position, namely on a raster line above, 35   to the right of, below, or to the left of the nominal position. Examples of these different locations are shown in Fig. 2. Depending on the location, the dot can for

example code bit pairs (0,0; 0,1; 1,0; and 1,1). The
location thus constitutes an example of a first parameter
for coding of position information in a coding pattern.

5   In the coding pattern 4 in Fig. 1, further informa-
tion in addition to the position information is coded.
For the coding of the further information, a second para-
meter of the dots is used. Fig. 3 shows an example of
this. Each dot now has, in addition to a location, also
a predetermined size value. In this example, each dot
10   either has the size value "large" (see for example the
dot 32) or the size value "small" (see for example the
dot 31). In this way, each dot can code 2^3, i.e. 8, dif-
ferent values, which permits coding of a larger pattern
than before, if the second parameter is used for position
15   information.

In this example, however, the second parameter is
used to code information other than position information.
For this purpose, and for increasing the robustness of
the coding, the coding pattern, as it is shown schemati-
20   cally in Fig. 4, has been divided into cells 40. The
cells are normally not marked on the base on which the
coding pattern is found and instead are virtual cells.
For the sake of clarity, however, they are indicated in
Fig. 4 by broken lines 41.

25   In this example, each cell contains four dots. Cells
with another number of dots can of course be used. The
cells do not have to be square, as in this example, and
instead they can have other shapes, for example rectan-
gular, triangular or hexagonal. The preferred shape can
30   be influenced by the design of the raster for the dots.
The cells do not all have to be the same size, if only
their extent can be determined.

As can be seen in Fig. 4, the cells also do not
overlap one another, and instead they are fixed in rela-
35   tion to the pattern, which means that their location is
easy to determine as soon as the position information in
the coding pattern has been decoded. In this example, the

coordinates of each point are coded with 6x6 dots. The coding is also "floating", which means that each partial area in the coding pattern which comprises 6x6 dots codes coordinates for a unique point. The coordinates are de-

5 fined for the upper left dot in each 6x6 partial area. This fact can be used to determine the location of the cells. If the cells are placed starting in the upper left corner, which has the coordinates x=0 and y=0, on the total position-coding pattern, the upper left corner of

10 each cell will have an even x-coordinate and an even y-coordinate, which can thus be used for determining the location of the cells on an arbitrary part of the coding pattern.

In order to increase the robustness of the coding,

15 each cell in this example contains either only small dots or two large dots and two small dots. The two large dots can be chosen among the four dots in (4!/2!x2!)) = 6 different ways. With the aid of the second parameter, it is thus possible in this case to code 1 + 6 = 7 different

20 cell values, in which case the cells with only small dots are preferably used to indicate "background". The other cell values can represent other forms of further information.

Now assume that a plurality of templates based on a

25 continuous position-coding pattern are stored in digital form in the user unit 2 in Fig. 1. Each template can be defined with two coordinate pairs which define the extent of the page, for example the coordinate pairs for the upper left corner and the lower right corner of the page,

30 and two coordinate pairs for each of the areas or fields which are defined on the page. In addition, each of the fields is provided with an indication concerning the field type or the field function, i.e. concerning how information recorded digitally from these fields is to

35 be interpreted and/or processed.

Fig. 5 shows an example of a physical page 50 which is intended to be used for sending an e-mail and which

corresponds to a digital template stored in the user
unit. On the page there is a field 51 which is intended
for graphic information, for example a handwritten mes-
sage. At the bottom of the page there is also a field 52
5 which is intended for address information which is to be
interpreted by ICR (Intelligent Character Recognition).
Finally, there is a field or a box 53 which is intended
to be filled in by the user when he or she wishes to send
the e-mail. Parts of the page outside the marked fields
10 are not intended for recording of information. The whole
page is provided with a continuous coding pattern (not
shown).

A user can fill in relevant information on the page
50 since the different fields are marked on the page in a
15 manner intelligible to the user. The information which is
recorded digitally from the page with the aid of the user
unit 2 consists of digital representations of partial
areas of the coding pattern. If the coding pattern were
only to contain position information, as is the case in
20 Fig. 2, the digitally recorded information would not con-
tain any information concerning from which field the in-
formation is recorded. Since the user unit contains the
digital template, the user unit can however determine
from which field the information is recorded and there-
25 fore how it is to be processed and/or interpreted.

Now assume, however, that a party wishes to have a
layout with the address field 52 and the "send" box 53
at the top of the page instead of at the bottom, and that
such a template is not pre-defined in the user unit 2.
30 It is not then sufficient to change the layout on the
physical page, and instead a corresponding digital temp-
late has to be found or created so that the user unit can
interpret the digitally recorded information and process
it in the correct way. If the layout is changed only on
35 the physical page and the same position-coding pattern is
used on this, the user unit will interpret the digitally
recorded information with the aid of the template corre-

sponding to Fig. 5. If the user then writes an e-mail
address at the top of the page in the address field
marked on the physical page, the user unit will only
interpret the information as message information because,

5   according to the template, the information comes from the
message field 51. In the interpretation, it is therefore
the digitally stored template which applies, and it may
be difficult to change for a party wishing to have a
layout other than those which are pre-defined.

10   A way of solving this problem is to define a plura-
lity of alternative fields in one and the same digital
template, for example one address field at the bottom of
the page and one at the top of the page, and to use the
further information which is coded in the coding pattern

15   in Fig. 3 to mark whether a field is activated or not. On
the physical page, fields which are to be activated are
coded with a first cell value, and fields which are not
to be activated with a second cell value. Alternatively,
active fields can be coded with a first value of the

20   second parameter, and inactive fields can be coded with
a second value of the second parameter, for example all
marks in an active field being made large in order to
indicate that the field is active. As a further example,
the values of the marks can vary in a predetermined man-

25   ner in an active field, for example every other one large
and every other one small, while all the marks in an in-
active field have one and the same value.

       A coding of the type described above can easily be
created upon production of the physical page. In addi-

30   tion, the user unit needs only to be supplied with infor-
mation on how active/inactive fields are coded.

       An alternative solution to the above problem is to
define different types of fields or areas from which re-
corded digital information is to be interpreted and/or

35   processed in different ways. The different field types
can be coded with the aid of different cell values. In
the unit which is to process the digitally recorded in-

formation there need then only be a single template with
a continuous position-coding pattern and a table of the
meaning of the different cell values. A party wishing
to create a physical page with its own layout can then
5   "paint" the layout with the aid of the different cell
values.

If the user unit 2 has a pen point and a sensor
which are offset in relation to one another, then, as has
already been mentioned, problems may arise in a boundary
10   area between two fields or areas because the pen point
points to a first field while the sensor records the
coding pattern in a second field. The problem can be
at least partially remedied if the cell values in the
boundary area are coded in a specific way so that the
15   processing unit can determine that the recorded coordi-
nates originate from a boundary area and should therefore
be processed in a special way.

One way of coding the boundary area is to mix cell
values from the two adjacent fields in a check pattern.
20   Another way is to allow the cell values to gradually
shift from one field's cell value to the other field's
cell value so that the processing unit can thereby deter-
mine where in the boundary area the coordinates have been
recorded. Of course, it is possible to create more com-
25   plicated layouts by mixing cells with two or more diffe-
rent cell values in a more advanced way.

One example of a more advanced coding is shown in
Fig. 6. Now assume that the sensor records 8x8 marks,
that cells with 2x2 marks are used, and that the sensor
30   sees 4x4 cells, as is shown at the center of Fig. 6,
where the cells which the sensor sees are designated 60.
In a boundary area, however, the further information
located at the pen point is of more interest than the
further information which the sensor sees. One can then
35   let each of the cells within a 4x2 cell area code the
cell value of a cell which is situated at the same dis-
tance from the sensor as the pen point in eight different

directions. In Fig. 6, this is shown schematically with
surrounding cells 61. The cell value of each cell 60 and
61 is marked in the cell, and broken lines 62 show relat-
ed cells. It will therefore be understood that the eight
5   topmost cells 60 and the eight bottommost cells 60 which
the sensor in this case sees code the values of the sur-
rounding eight cells 61. By decoding of the further in-
formation in the coding pattern which the sensor records,
it is thus possible to determine the further information
10   which is found in the coding pattern at the pen point for
different rotations of the pen, whereby it is possible
for example to determine whether the tip of the pen point
situated in an active field or not.

The coding of the coding pattern can take place in
15   a coding device, for example belonging to a party wish-
ing to create a page with special layout for information
management. An example of a coding device is shown sche-
matically in Fig. 7. The coding device, which for example
can be realized with a conventional personal computer,
20   comprises a processor unit 70 which, in addition to the
actual processor 71, comprises a working memory 72 and a
program memory 73 which stores a program for creating the
coding pattern. The coding device further comprises an
input means 74, which makes it possible for a user to
25   input information concerning the desired page layout into
the processor unit. The input means 74 can for example be
a keyboard or a mouse or some similar type of input unit
normally used together with a computer. Also coupled to
the coding device there may be a unit 75 which, on the
30   basis of the digital representation of the coding pat-
tern, applies the coding pattern onto a product. The unit
can, for example, be a printer which prints out the cod-
ing pattern onto a sheet of paper or some form of print-
ing device.

35   The way in which the coding proceeds is described
below with reference to the flow chart in Fig. 8. This
example relates to the case when the user creates a page

layout by depicting areas on the page with the aid of the
second parameter of the marks.

        In a first step 80, the processor receives an indi-
cation concerning for which coordinate area coordinates
5   are to be coded. The indication can come as a direct or
processed input signal from the user. The extent of the
coordinate area, i.e. of the page, can be defined with
the aid of a coordinate pair which defines the upper left
corner for the coordinate area, and a width and a height
10   of the coordinate area. If these values are not stored in
advance, they can be given directly by the user. In con-
nection with this step, space in the working memory 72
is allocated for storing a digital representation of the
coding pattern. For each mark included in the coding pat-
15   tern, the processor thereafter calculates, in step 81, a
value for a first parameter, which in this example is the
location of the mark, according to a predetermined algo-
rithm. The way in which such an algorithm can be built up
is disclosed in above-mentioned WO 01/26032. The value
20   for the first parameter for the respective mark is stored
in a first matrix in the working memory 72. The value can
for example be given as a number between 0 and 3, where 0
signifies that the mark is offset to the right from its
nominal position, 1 that it is offset upwards, 2 that it
25   is offset to the left, and 3 that it is offset downwards.

        After this, the processor 71 receives an indication
of the extent of at least one field which is to be marked
out by using the second parameter, step 82. This indica-
tion can, for example, come in the form of a direct or
30   processed input signal from the user, the field being
described with the aid of a coordinate pair which defines
the upper left corner for the field, the width and the
height of the field calculated by number of cells, and
the cell value or the cell values to be defined in the
35   field. On the basis of the input signal, the processor
determines a second matrix which defines the cell values
for the whole coordinate area and which constitutes an

input signal to the next step in the coding. In the following step, the processor also determines, on the basis of the second matrix and in accordance with a predetermined algorithm, a value for a second parameter for each

5   of the marks, step 83, and stores these calculated values in the memory. More precisely, the processor determines a third matrix which has the same size as the first matrix, and it allocates to each mark the value zero or four, where zero indicates a small dot and four a large dot.

10   The algorithm for calculating the value for the second parameter can be determined by a person skilled in the art on the basis of the above description of how the second parameter can be used. Finally, the first matrix and the third matrix are put together by the values at

15   the same location being added so that a fourth matrix is formed where each element has a value between zero and seven. Each element corresponds to a mark in the pattern and defines its location and size in accordance with the following:

20   0 =   small dot, offset to the right
         1 =   small dot, offset upwards
         2 =   small dot, offset to the left
         3 =   small dot, offset downwards
         4 =   large dot, offset to the right

25   5 =   large dot, offset upwards
         6 =   large dot, offset to the left
         7 =   large dot, offset downwards.

When the coding is finished, the coding pattern can, if so desired, be printed out on the printer 75. The

30   fourth matrix may, for example, be sent to a program which generates a PostScript file for direct printout on a printer.

In an alternative coding embodiment, where one or more of a number of predefined fields in a template are

35   to be activated, the user may select one of a plurality of templates which have a number of predefined fields. He may also indicate to the processor for which coordinate

area coordinates are to be coded in the template. The
extent of the coordinate area may be given by the temp-
late or indicated by the user. The user furthermore indi-
cates which of the predefined fields is to be activated.

5   By means of these inputs, the processor can code the
coding pattern substantially as described above.

Fig. 9 shows an example of how it is possible to
realize the user unit 2 in Fig. 1, which can be used as
a decoding device. It comprises a casing 91 which is

10   shaped approximately as a pen. In the short side of the
casing there is an opening 92. The short side is intend-
ed to bear against or be held at a slight distance from
the surface from which the coding pattern 4 is to be
recorded.

15   The casing basically accommodates an optics part,
an electronic circuitry part and a power supply.

The optics part comprises at least one light-emit-
ting diode 93 for illuminating the surface which is to be
imaged, and a light-sensitive area sensor 94, for example

20   a CCD or CMOS sensor, for recording a two-dimensional
image. Optionally, the device may additionally contain an
optical system such as a mirror and/or lens system. The
light-emitting diode may be an infrared light-emitting
diode, and the sensor may be sensitive to infrared light.

25   The power supply for the device is obtained from a
battery 95 which is mounted in a separate compartment in
the casing. It is also conceivable to supply power via a
cable from an external power source (not shown).

The electronic circuitry part comprises a processor

30   unit 96 with a processor which is programmed to read
images from the sensor and to decode the coding pattern
in these images, and a working memory and program memory.
The processor can also be programmed to execute certain
operations on the basis of the decoded information. The

35   processor can, for example, send information to a speci-
fic address included in the decoded information as a
result of its interpreting and processing the decoded

information. Alternatively, the processor can simply send the decoded information onwards to another unit, for example the external unit 3 in Fig. 1, for interpreting and processing of the information.

5   In this embodiment, the device further comprises a pen point 97 with which it is possible to write conventional ink-based writing on a base from which the coding pattern is to be recorded. The pen point 97 can be retractable and extendable so that the user can control

10   whether it is to be used or not. In some applications, the device does not need to have a pen point at all.

The ink-based writing is suitably of such a type that it is transparent to infrared light and the marks absorb infrared light. By using a light-emitting diode

15   which emits infrared light, and a sensor which is sensitive to infrared light, the detection of the pattern takes place without the above-mentioned writing interfering with the pattern.

The device may further comprise buttons 98 with

20   which the device can be activated and controlled. It also has a transceiver 99 for wireless transmission, for example by IR light, radio waves or ultrasound, of information to and from the device. The device may further comprise a display 900 for showing the recorded and/or pro-

25   cessed information.

The device may be divided into different physical casings, a first casing containing components which are necessary for recording images of the coding pattern and for transmitting these to components which are located

30   in a second casing and which decode the coding pattern in the recorded image or images.

An example of how the coding pattern can be decoded is now described below with reference to Fig. 10. In this example it is assumed that the decoding is carried out in

35   a user unit. It can, however, also be carried out in an external unit.

In a first step 100, the processor 96 in the user
unit 2 receives a digital representation of the coding
pattern which the sensor 94 has recorded locally at the
user unit end. Then, in step 101, the processor decodes

5   the position information in the coding pattern by iden-
tifying the marks in the digital representation, deter-
mining the virtual raster and the location of the marks
in relation to the virtual raster, and calculating co-
ordinates for each point on the basis of the location of

10 the marks in accordance with a predetermined algorithm.
A more detailed description of how the position informa-
tion can be decoded is given in WO 01/26032. It should be
emphasized that the digital representation may include
more marks than required for the decoding of the position

15 information, which means that the processor need not use
all the marks in the digital representation for decoding
the position information.

When the position information has been decoded, the
processor, in step 102, determines the location of the

20 cells with the aid of the coordinates. Thereafter, the
processor can determine the cell value of each cell by
determining the size of the marks in the digital repre-
sentation. Since it is given that each cell will contain
two small and two large marks, or just four small marks,

25 it is relatively easy for the processor to determine
which marks are small and which are large, by comparing
the sizes of the marks with one another within each cell.
When the sizes of the different marks have been deter-
mined, the cell value is easy to determine, for example

30 by using a table, step 103. Optionally, the processor can
make an appraisal of how reliable the cell value is on
the basis of how reliable the size determination is for
the marks in the current cell.

The cell values can of course be determined in other

35 ways. One alternative is to determine the size of each
mark and, by comparing this with a predetermined or adap-
tively modifiable size distribution which reflects that

the marks are recorded in different perspectives and with different lighting, to determine the probability of each mark being large or small. By multiplying together the probabilities of different combinations of small and

5   large marks, the processor can determine the cell value which is most probable.

When the processor has determined the cell value for a desired number of the cells which are seen in the digital representation it has received, the processor can

10   execute an evaluation step 104 in which the cell values for a plurality of cells are compared and any estimated or calculated probabilities for the cell values are corrected on the basis of the comparison. If the cells neighboring a particular cell have the same cell value

15   as the particular cell, the processor can for example increase the estimated/calculated probability of the particular cell having this cell value. If, by contrast, a plurality of neighboring cells have a cell value different than that of the particular cell, this can lead to

20   a reduction in the probability of the particular cell's cell value. In the evaluation step, account can also be taken of any information on the distribution of the cell values between the cells.

When the processor has finally determined which cell

25   value or cell values is/are coded by the coding pattern in the current digital representation of the coding pattern, the processor can either itself interpret and process the position information, i.e. the coordinates, on the basis of the decoded further information, i.e. the

30   cell values, or it can send the decoded information to some other unit for interpretation and processing.

It should also be mentioned that the processor need not use all the marks in the digital representation when decoding the further information, because the digital

35   representation may contain more marks than required for the decoding of the further information.

27

Alternative Embodiments

In the above examples, a coding pattern is used in which the position information is coded using the location of the marks, and further information is coded using

5 the size of the marks. Of course, both the position information and the further information can be coded using parameters other than those exemplified here. As an alternative, the shape of a mark can be used as a parameter. The marks can, for example, have different values

10 on the basis of whether they are circular, triangular, rectangular, star-shaped, elliptic, hexagonal or of some other detectable shape. In order to be able to detect different shapes in different perspectives and different lighting, it may however be necessary to use a sensor

15 with relatively high resolution. As a further alternative, the color of the mark can be used, so that the value of the mark depends on the color. However, for this purpose, a color sensor is required, or illumination with light of different wavelengths.

20 The principle of using a second parameter in order to code the further information can also be used for position-coding patterns of fundamentally different construction. For example, the position-coding pattern does not need to be floating.

25 In the examples described above, the marks are also in the form of circular dots. It is of course possible to use marks of different shape, for example triangular, square, elliptic, rectangular or hexagonal dots.

In the examples described above, all the cells have

30 two large dots and two small dots or four small dots for coding of seven different cell values. It is of course possible to have smaller or larger cells with fewer or more cell values which are coded with other combinations of values of the second parameter.

35 In the example above, the further information is coded using a second parameter. However, it would also be possible to code the further information directly in the

position information itself by coding the same position
in two or more different ways depending on the value for
the further information. This can be done in the follow-
ing way, for example. The position-coding pattern in
5   WO 01/26032 is based on a bit sequence which has the
property that if a partial sequence with a predetermin-
ed number of bits is taken out of the bit sequence, this
partial sequence has an unambiguously defined location
in the bit sequence. This property applies also when the
10   start and the end of the sequence are joined together,
which sequence can thus be regarded as a ring. In coding
of positions in the horizontal direction, for example,
the bit sequences are written repeatedly in columns in
a vertical direction. The bit sequences in different
15   columns are written with different rotations, the columns
thus being started at different locations in the bit
sequence. The position coding in the horizontal direction
is based on the differences between the locations in the
bit sequence of partial sequences in the same vertical
20   positions in a number of adjacent columns. The position
coding in the vertical direction is done in a correspond-
ing manner and is thus based on the differences between
the locations in the bit sequence of partial sequences
in the same horizontal positions in a number of adja-
25   cent rows. Since the position coding is described in
WO 01/26032 and is not required for understanding how
the further information is coded, it is not described
in more detail here. Now assume now that a bit sequence
is created which is made up of two ring-shaped sections
30   which each have the above-mentioned property that, if a
partial sequence of a predetermined length is taken out,
its position in the ring-shaped section is unambiguously
defined. Now further assume that these two ring-shaped
sections have a partial sequence which is common and
35   which thus couples the sections together to form an
eight-shaped bit sequence. It is then possible to code
some further information by defining that partial sequ-

ences belonging to the first section represent further
information in the form of a first value, for example
a zero, and partial sequences belonging to the second
section represent further information in the form of

5   a second value, for example a one. However, this means
that fewer positions can be coded using the bit sequence
because the partial sequences in the second section code
the same positions in the bit sequence as the partial
sequences in the first section. For example, when a field

10   on a physical page with a position-coding pattern is to
be coded as activated, i.e. with a first value for the
further information, the bit sequences in the columns and
rows are written in such a way that the first section of
the bit sequence is repeated until the field which is to

15   be activated is reached. A transition to the second sec-
tion then takes place as soon as the writing of the bit
sequence reaches the partial sequence which is common to
the first section and the second section. Thereafter, the
second section is repeated until the end of the field

20   which is to be activated is reached, whereupon transition
to the first section takes place as soon as the common
partial sequence is reached. Since the bit sequences are
written with different rotation in the different columns,
the common partial sequence is not reached exactly at the

25   same time in all columns. For this reason, the boundaries
of the fields will be slightly uneven. To overcome this
problem, however, it is possible to define that only the
area which both in the horizontal direction and in the
vertical direction is coded with the second section of

30   the bit sequence defines an activated field. The decoding
takes place in the manner described in WO 01/26032, but,
when the position of a partial sequence in the bit sequ-
ence is to be determined, one also determines to which
section of the bit sequence the partial sequence belongs

35   and thus the value of the further information.

The coding and decoding can take place using the
same means which have been described above in connection

with coding and decoding of further information using a second parameter.

Instead of a bit sequence, a number sequence with another base can be used. Moreover, a plurality of loops or sections can be produced in the number sequence so that a plurality of values of the further information can be coded.

When this position-coding pattern is arranged on a product, a product is thus obtained which is provided with a position-coding pattern which codes coordinates for a plurality of points on the product on the basis of a number sequence which has the property that a partial sequence of the number sequence of a predetermined length has an unambiguously defined position in the number sequence, said number sequence having at least a first section and a second section which each have the above-mentioned property, and areas with a position-coding pattern on the product having different properties depending on whether they are coded with the first section or the second section of the number sequence.

31

CLAIMS

1. A product which is provided with a coding pat-
tern, which codes position information in the form of
coordinates for a plurality of points on the product with
the aid of a plurality of marks belonging to each point,
the marks having a first parameter which varies for cod-
ing of the position information, c h a r a c t e r i z e d
in that the marks have a second parameter which varies
for coding of further information in the coding pattern.

2. The product as claimed in claim 1, in which the
second parameter is detectable independently of the first
parameter.

3. The product as claimed in claim 1 or 2, in which
the first parameter and the second parameter is one of
the following pairs: location and size; location and
color; size and location; size and shape; size and color;
shape and location; shape and color; shape and size;
color and location; color and size; and color and shape.

4. The product as claimed in claim 1, 2 or 3, in
which the further information is further position
information.

5. The product as claimed in any one of claims 1-3,
in which the further information is information other
than position information.

6. The product as claimed in any one of claims 1, 2,
3 and 5, in which an area of the coding pattern is marked
out with the aid of the second parameter.

7. The product as claimed in claim 6, in which the
area of the coding pattern is associated with a predeter-
mined function.

8. The product as claimed in any one of claims 1,
2, 3, and 5, in which the further information defines
at least two different areas on the coding pattern.

9. The product as claimed in claim 8, in which the further information defines how coordinates which are recorded from said at least two different areas are to be processed.

5   10. The product as claimed in any one of claims 1, 2, 3 and 5, in which the further information defines whether a predetermined area in the coding pattern is activated or not.

        11. The product as claimed in any one of the pre-

10   ceding claims, in which the coding pattern is divided into a plurality of cells, each of these comprising at least two marks, and in which the further information consists of a cell value which is coded by said at least two marks for each cell.

15   12. The product as claimed in claim 11, in which the cells comprise fewer marks than said plurality of marks belonging to each point.

        13. The product as claimed in claim 11 or 12, in which each mark has one of at least two predetermined

20   values for the second parameter, and in which each cell comprises at least one mark with a first value of said at least two predetermined values and at least one mark with a second of said at least two predetermined parameters.

        14. The product as claimed in any one of claims 11-

25   13, in which the coding pattern comprises a first area and a second area, and in which the cells in the first area have a first cell value and the cells in the second area have a second cell value.

        15. The product as claimed in claim 14, in which

30   a boundary area between the first area and the second area comprises cells with the first cell value and cells with the second cell value.

        16. A method in a coding device for coding of a coding pattern which codes position information in the

35   form of coordinates for a plurality of points with the aid of a plurality of marks belonging to each point, comprising allocating, for the coding of the position

●   ●

33

information, to each mark in the coding pattern one of
at least two predetermined values for a first parameter,
c h a r a c t e r i z e d   by allocating to each mark one
of at least two predetermined values for a second para-
5   meter for coding of further information in the coding
pattern.

17. A method as claimed in claim 16, in which the
second parameter, which is allocated to said each mark,
is detectable independently of the first parameter.

10   18. The method as claimed in claim 17, in which the
first parameter and the second parameter is one of the
following pairs: location and size; location and color;
size and location; size and shape; size and color; shape
and location; shape and color; shape and size; color and

15   location; color and size; and color and shape.

19. The method as claimed in claim 16, 17 or 18,
comprising allocating to marks, which belong to points
within an area of the coding pattern, values for the
second parameter, which makes it possible, on the basis

20   of the marks, to detect the extent of said area in the
coding pattern.

20. The method as claimed in claim 19, in which the
allocation to marks of values for the second parameter
is carried out depending on how coordinates recorded from

25   said area of the coding pattern is to be processed.

21. The method as claimed in any one of claims 16-
18, comprising marking a predetermined area of the coding
pattern as activated, by allocating to marks which belong
to points within the predetermined area a predetermined

30   value for the second parameter.

22. The method as claimed in any one of claims 16-
20, further comprising dividing the coding pattern into
cells, each of these comprising at least two marks, and
allocating to each cell a cell value which constitutes

35   the further information, the allocation to each mark of
one of at least two predetermined values for the second
parameter taking place dependent on the cell value.

23. The method as claimed in claim 22, in which the marks within each cell are allocated values for the second parameter so that each cell contains at least one mark with each of the predetermined values for the second

5   parameter.

24. The method as claimed in any one of claims 16-23, further comprising creating a product with a coding pattern, by applying the coding pattern with marks which have the allocated values for the first parameter and the

10   second parameter, on a product.

25. A computer program, which comprises instructions for making a computer execute a method according to any one of claims 16-24.

26. A device for coding of a coding pattern, which

15   codes position information in the form of coordinates for a plurality of points with the aid of a plurality of marks belonging to each point, which device comprises processing means for determining a value for a first parameter and a value for a second parameter for each

20   mark, and a memory for storing the values of the marks for the first parameter and the second parameter.

27. A method for decoding, in a decoding device, of a coding pattern which codes position information in the form of coordinates for a plurality of points on a pro-

25   duct with the aid of a plurality of marks belonging to each point, comprising receiving a digital representation of the coding pattern, decoding the position information with the aid of the value for the first parameter for at least some of the marks in the digital representation,

30   c h a r a c t e r i z e d by decoding further information from the coding pattern on the basis of the value for a second parameter for at least some of the marks in the digital representation.

28. The method as claimed in claim 27, in which the

35   decoding of the position information and the decoding of further information is made independently of each other.

29. The method as claimed in claim 27 or 28, in which the first parameter and the second parameter is one of the following pairs: location and size; location and color; size and location; size and shape; size and color; shape and location; shape and color; shape and size; color and location; color and size; and color and shape.

30. The method as claimed in any one of claims 27-29, further comprising determining how coordinates which have been recorded from the coding pattern are to be processed on the basis of the value of the second parameter for at least some of the marks in the digital representation.

31. The method as claimed in any one of claims 27-29, further comprising determining whether a pre-defined area in the coding pattern is activated or not on the basis of the value of the second parameter for marks which belong to points in the area.

32. The method as claimed in any one of claims 25-29, further comprising dividing, on the basis of the position information, the digital representation of the coding pattern into cells and determining a cell value for each cell on the basis of the value of the second parameter for the marks of the cell.
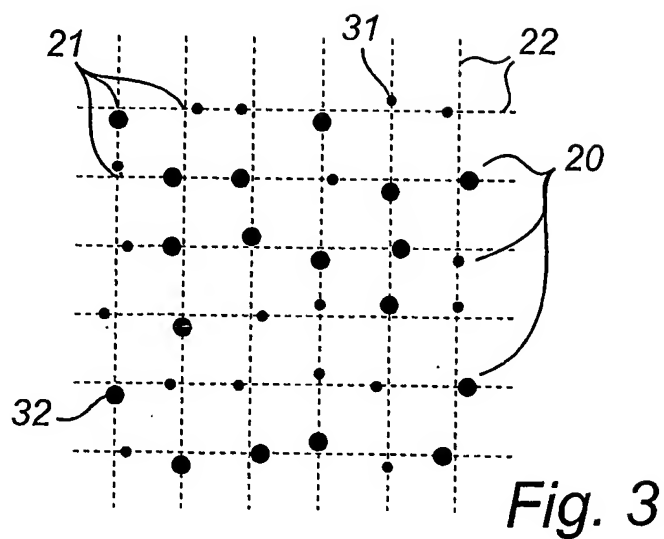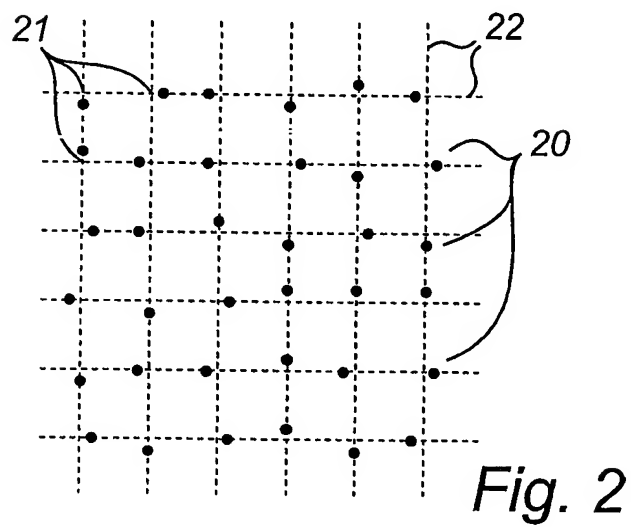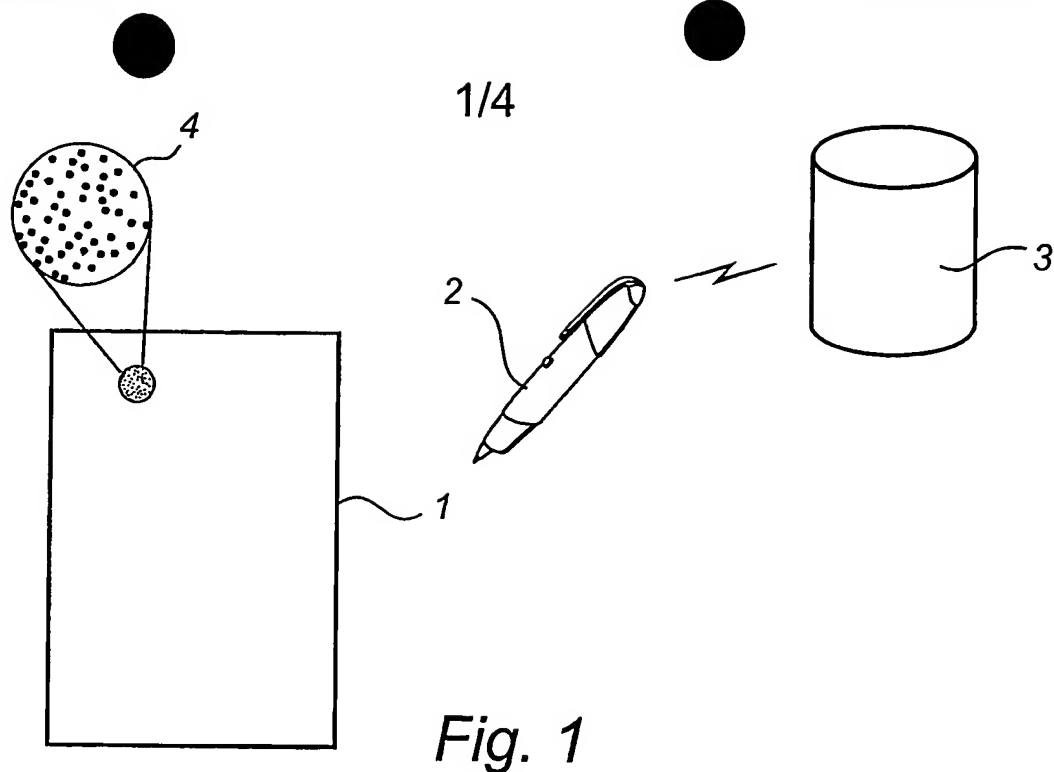
33. The method as claimed in claim 32, further comprising processing the position information dependent on the cell values for corresponding cells.

34. A computer program, which comprises instructions for making a computer execute a method according to any one of claims 27-33.

35. A device for decoding of a coding pattern which codes position information in the form of coordinates for a plurality of points on a product with the aid of a plurality of marks belonging to each point, which device comprises processing means which are arranged to receive a digital representation of the coding pattern, to decode the position information with the aid of the value for the first parameter for at least some of the marks in the

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digital representation, c h a r a c t e r i z e d in that
the processing means are also arranged to decode further
information from the coding pattern on the basis of the
value for a second parameter for at least some of the
5   marks in the digital representation.

36. A product with a coding pattern which codes
coordinates for a plurality of points on the product
through variation of a first parameter of a plurality of
marks belonging to each point; which coding pattern is
10   intended for digital recording of information which is
written on the coding pattern; and which coding pattern
comprises at least a first area and a second area; said
information which is recorded digitally being intended
to be processed in different ways depending on from which
15   of said areas the information is recorded, and the first
area and the second area being coded in the coding pat-
tern through variation of a second parameter of the
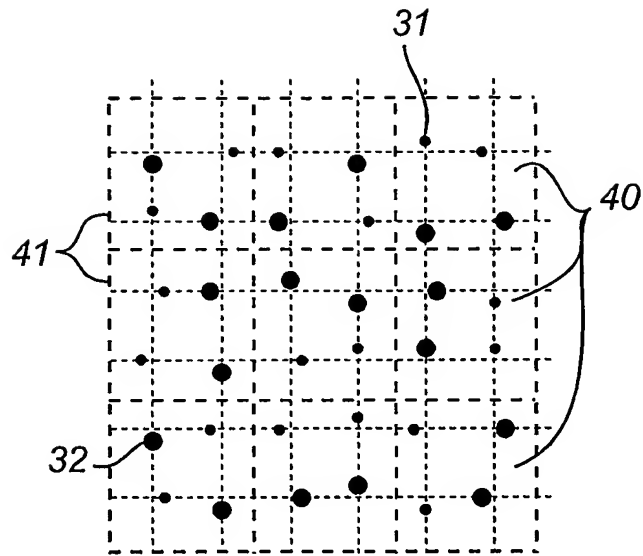marks.

20

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

```
        ┌─────────┐
        │  START  │
        └─────────┘
             │
             ▼
  ┌───────────────────────┐
  │  RECEIVE INDICATION    │⟋ 80
  │  OF COORDINATE AREA    │
  └───────────────────────┘
             │
             ▼
  ┌───────────────────────┐
  │  DETERMINE FIRST       │
  │  PARAMETER FOR EACH    │⟋ 81
  │  MARK                  │
  └───────────────────────┘
             │
             ▼
  ┌───────────────────────┐
  │  RECEIVE INDICATION    │⟋ 82
  │  OF FIELD              │
  └───────────────────────┘
             │
             ▼
  ┌───────────────────────┐
  │  DETERMINE SECOND      │
  │  PARAMETER FOR EACH    │⟋ 83
  │  MARK                  │
  └───────────────────────┘
             │
             ▼
```

Fig. 8

Fig. 9

RECEIVE DIGITAL
REPRESENTATION
OF CODING PATTERN — 100

DECODE THE
POSITION INFORMATION — 101

DETERMINE THE LOCATION
OF THE CELLS — 102

DETERMINE THE
CELL VALUES — 103

EVALUATE THE
CELL VALUES — 104   Fig. 10
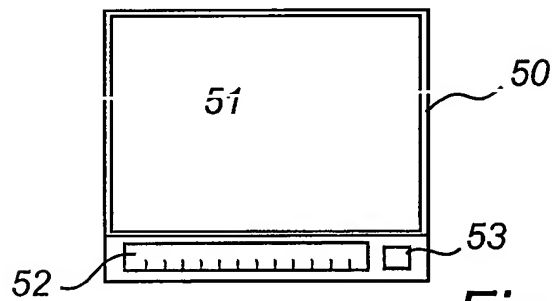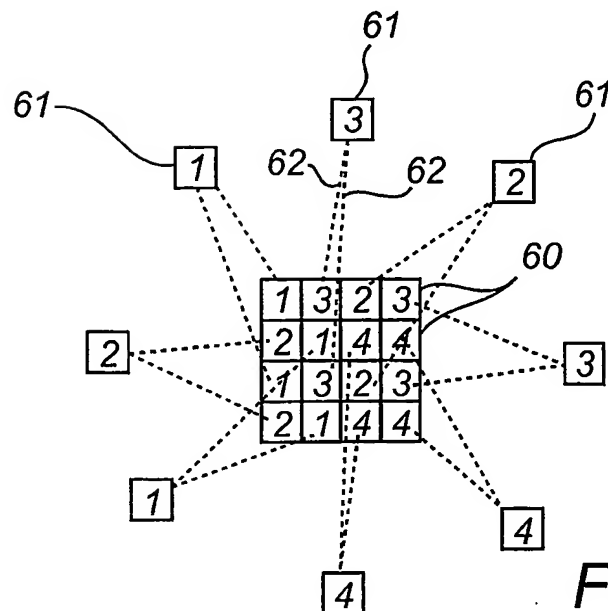
INTERNATIONAL SEARCH REPORT
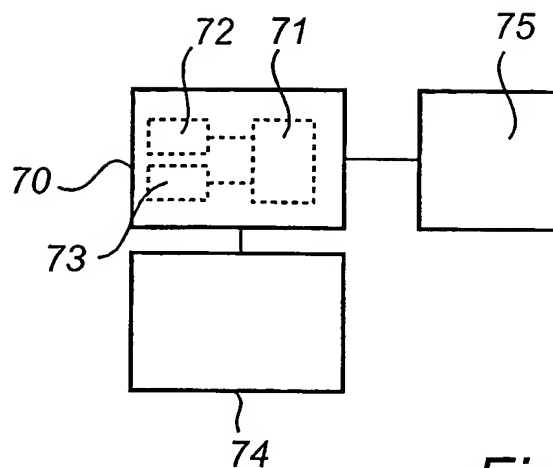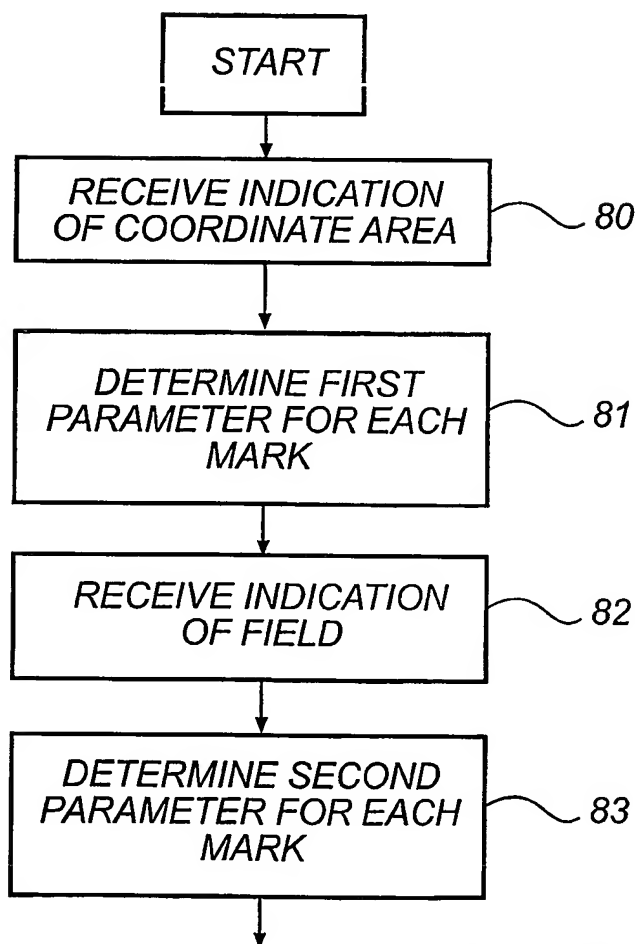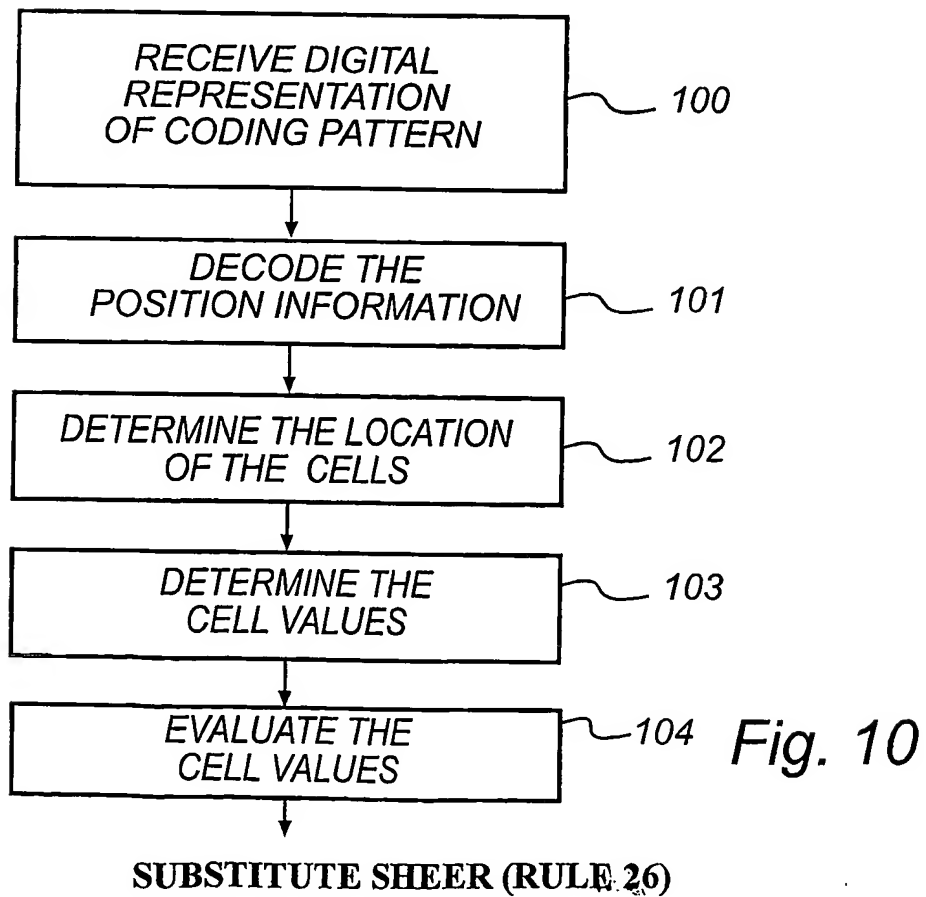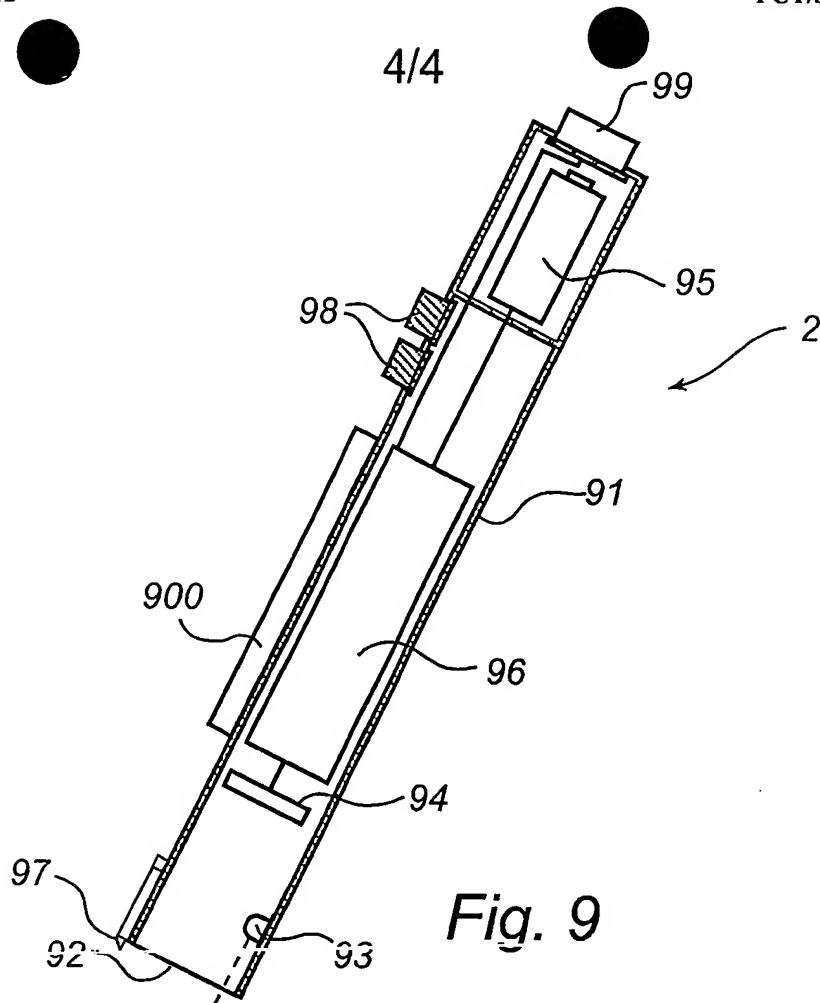
International application No.

/SE 02/01641

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G06K 19/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G06K, G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"&"	document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
3 December 2002	1 1 -12- 2002

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